

Three new species of *Rosulabryum* (Bryopsida, Bryaceae) from Australia

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Abstract

Spence, J.R.¹ and Ramsay, H.P.² (¹National Park Service, Glen Canyon National Recreation Area, P.O. Box 1507, Page, AZ 86040 USA, ²National Herbarium of New South Wales, Mrs Macquaries Road, Royal Botanic Gardens, Sydney, NSW 2000, Australia) 1999. Three new species of *Rosulabryum* (Bryopsida, Bryaceae) from Australia. *Telopea* 8(3): 325–335. Three species are described as new: ***Rosulabryum epiphyticum***, a corticolous or epiphytic species from NSW and Queensland, ***Rosulabryum queenslandicum***, a diminutive species on dryish soil banks in central Queensland and the Northern Territory, and ***Rosulabryum lamingtonicum*** which occurs in the high elevation forests of the Atherton Tableland, north Queensland, and the Lamington Plateau, McPherson Range, on the New South Wales–Queensland border. Distributional notes and a key to all species of the genus in Australasia are provided.

Introduction

The genus *Rosulabryum* was described by Spence (1996) for the species of *Bryum* in sections *Capillaria* and *Rosulata* (cf. Ochi 1992). In that paper, Spence transferred eleven Australasian species to the new genus and 43 species were listed as belonging to *Rosulabryum* from other regions. More recently, we (Spence & Ramsay unpublished data) have suggested that, worldwide, the genus is more species-rich than previously thought, with at least 70 species currently known.

Ochi (1970) recognised six species in *Bryum* sections *Capillaria* and *Rosulata* from Australasia, while Syed (1973) and Mohamed (1979) recognised a few additional species. Collecting since 1970 has added several species to the list. Prior to work for the Flora of Australia, 12 described species were listed for the region (Streimann & Curnow 1989). However, during the course of recent field work in New South Wales and Queensland, many new collections have been made that we have been unable to assign to known species. In this paper we describe three new species of *Rosulabryum* based on these collections. Following the descriptions, we provide a key to all 15 species in Australasia, and discuss distributional patterns.

The characteristics of the genus *Rosulabryum* are: plants usually rosulate, densely radiculose with coloured papillose rhizoids, capsules with unreduced peristomes with minor differences in the endostome, generally ovate to obovate leaves with serrate margins, rhizoidal tubers and, in some species, filiform gemmae in leaf axils. Three new species are described here.

Taxonomy

1. *Rosulabryum epiphyticum* J.R. Spence & H.P. Ramsay, sp. nov.

R. capillari affinis. Caules elongati foliis aequidistantibus; folia ovata vel obovata, distaliter subtiliter serrulata, immarginata, costa percurrenti vel brevissima excurrenti; gemmae foliorum filiformes, axillares in caulibus sterilibus.

Type: New South Wales: epiphytic on orchids in pots at Macquarie University, originally from Port Macquarie area, North Coast (31°27'S, 152°55'E), *A.J. Downing s.n.*, 8 Aug 1991 (holo BRI; iso NSW).

Diocious. *Plants* green, becoming golden-brown with age, sparingly branched by subfloral innovations, sparsely tomentose; stems short, 5–15 mm long, with equidistant leaves, not rosulate; *rhizoids* pale brown to orange-brown, coarsely papillose; *leaves* bright green, becoming golden with age, 1–2 mm long, ovate to obovate, border lacking or weak, with a single layer of thick-walled elongate, narrow cells, margins entire to slightly serrulate in upper part, plane, upper-middle *lamina cells* rhomboidal, 35–90 µm long by 10–20 µm wide (3–4:1), becoming longer (to 100 µm) and regularly rectangular below, innovation leaves similar although somewhat smaller; *costa* brown, percurrent to shortly excurrent as a stout short (to 150 µm) point, often somewhat toothed, in cross-section showing a strong dorsal stereid band and guide cells. *Perichaetial leaves* smaller, inner leaves slender ovate-lanceolate to triangular, serrulate above, margins revolute, *perigonal leaves* more oblong with costa failing below apex. *Gemmae* filiform, mostly unbranched, present in axils of upper leaves on sterile stems, brownish, coarsely papillose; rhizoidal tubers occasionally present on long rhizoids in substratum, dark reddish-brown, spherical, 200–250 µm wide, cells 12–25 µm across, walls not protuberant. *Seta* 2–2.5 cm long; *capsule* inclined to nutant, 2–3 mm long, brown, narrowly clavate to cylindrical, mouth broad; *peristome* double, exostome teeth 16, lanceolate, 350–400 µm, trabeculate; endostome with high basal membrane (200–250 µm), segments 16, papillose narrowly split, cilia 2, appendiculate. *Spores* smooth, 12–15 µm wide. Chromosome number $n=11$ (fide Ramsay & Spence 1996). (Fig. 1).

Derivation of epithet: this is the only known species of *Rosulabryum* that can occur as a true epiphyte on twigs or branches, although it may also be corticolous and is sometimes found on rocks.

Habitat: a rare epiphyte on tree and shrub twigs or orchid roots, sometimes corticolous or on rocks in subtropical to tropical rainforest.

Distribution: occurs in rainforest along the coastal ranges from northern New South Wales to north-east Queensland.

Other specimens examined: Queensland: Downey Creek, Innisfail, *Stone 24701*, 19 Sep 1987 (MELU); Rifle Bird Creek, Binna Burra, *Stone 12919*, 12 June 1975 (MELU); Expedition Range, *Stone 21181*, 8 Aug 1983 (MELU); Mt Haig, *Stone 22260*, 5 July 1987 (MELU); Pease's Lookout, Eungella N.P., *Stone 12505*, 6 June 1975 (MELU); Mt Nebo, *Stone 13130*, 14 May 1978 (MELU); Stairway Falls, Lamington N.P., *Stone 11998*, 26 Oct 1976 (MELU).

Note: a distinctive species with a habitat unique for *Rosulabryum*. The elongate stems with ovate leaves, costa percurrent or very shortly excurrent, filiform gemmae in leaf axils and epiphytic habit are diagnostic.

2. *Rosulabryum queenslandicum* J.R. Spence & H.P. Ramsay, sp. nov.

R. capillari affinis. Plantae minutae caulibus sub 5 mm longis; folia sub 1 mm longa, obovata vel ovata, distaliter subtiliter serrulata, immarginata, costa percurrenti vel brevissime excurrenti punctum crassum formanti; tuberae rhizoidales praesentes, 100–200 µm latae, ferruginae.

Type: Queensland: on dry shaded soil bank along track to Aljon Falls, Carnarvon Gorge National Park (25°02'S, 148°10'E), *J.R. Spence 5167*, 2 Jan 1993 (holo BRI).

Diocious. *Plants* small, bright green shoots sometimes mixed with other mosses; *stems* short, <5 mm long, unbranched, or with a few subfloral innovations, often leafy throughout, sparsely tomentose; *rhizoids* pale brown, papillose; leaves crowded into a



Fig. 1. *Rosulabryum epiphyticum*. a, habits (dry); b, habit with sporophyte attached (wet); c, leaf; d, leaf apical cells; e, transverse section of leaf; f, midleaf cells; g, basal cells; h, peristome; i, filamentous gemmae; j, gemma – rhizoidal tuber (from Downing s.n). Scale bars: a–c = 1 mm; d, f–j = 100 μm; e = 400 μm.

rosette on fertile stems, reduced in size below, sterile innovations with leaves arranged equidistant along stem; *leaves* narrowly ovate to obovate, 0.5–1.5 mm long, unbordered, contorted when dry, erect-spreading when wet, margins plane throughout, upper margins entire or rarely finely serrulate; upper and middle lamina cells irregularly rhomboidal, 35–50 μm long and 12–18 μm wide (2–3:1), becoming more rectangular and longer below; costa variable, not reaching apex to shortly percurrent in a stout mucro, apiculus present if costa not excurrent, golden-brown, in cross-section with strong dorsal stereid band and guide cells; *perigonal* and *perichaetial leaves* crowded, inner leaves smaller than outer leaves, ovate-lanceolate to triangular, with strongly bordered margins, serrulate above, innermost leaves very small, broadly ovate to obovate; costa failing below apex. *Gemmae* as small irregularly spherical rhizoidal tubers often present on long rhizoids in substratum, reddish-brown or orange-brown, darker than rhizoids, 50–150 μm wide, cells 25–50 μm across; filamentous gemmae not present. *Seta* short, 5–8 mm long; capsule cylindric, brownish, 2 mm long, wide at mouth; *peristome* double, well-developed; exostome teeth pale-golden, 300–350 μm long, finely papillose above, reticulate below, strongly bordered and trabeculate; endostome with high basal membrane, 250 μm , segments narrowly split, cilia 2–3, appendiculate; exothecial cells quadrate above, 12–25 μm wide, becoming irregularly elongate below, 45–100 μm long by 7–20 μm wide, walls thick and sinuose. *Spores* finely papillose, 8–13 μm wide. Chromosome number unknown. (Fig. 2).

Derivation of epithet: the name reflects the location of the type collection.

Habitat: shaded soil on earth bank.

Distribution: this species is known from the type locality, two other sites in Queensland and one from the Northern Territory.

Other specimens examined: Queensland: Mt Nebo, *Stone 13132*, 14 May 1978 (MELU); Blackdown, *Stone 20226*, 27 July 1982 (MELU).

Northern Territory: 3.2 km NE of Mt Zeil trig, *Beaglehole 27344*, 20 July 1968 (MEL).

Notes: *R. queenslandicum* should prove to be more widespread because its habitat is widespread west of the Great Dividing Range in Queensland. Superficially, it looks like a member of *Bryum* section *Erythrocarpa*. However, it can be distinguished from species in that group that might occur in similar habitats, e.g. *Bryum radiculosum*, by a variety of characters. Prominent among these are the leaf shape and margins, and the capsule shape. *R. queenslandicum* has mostly ovate to obovate, more or less entire leaves, a plane border, and an elongate cylindrical capsule with a wide mouth. *Bryum radiculosum* and its allies have ovate-lanceolate leaves, serrate upper leaf margins, strongly revolute borders, and pyriform capsules with mouths narrower than the urn.

3. *Rosulabryum lamingtonicum* J.R. Spence & H.P. Ramsay, sp. nov.

Plantae parvae; folia rosulata obovata in sicco contorta, costa apicem non attingenti vel percurrenti apiculo parvo incolorata plerumque praesanti; caules steriles elongati foliis aequidistantibus; folia caulina a foliis rosulatis valde differentia, decurrentia, ovata vel obovata, costa apicem non attingenti, margine valde serrato dentibus ad angulum circa 90° patentibus.

Type: Queensland: Cedar Creek N.P., Tambourine Mtn (27°54'S, 153°11'E), *A. Mertens 3*, 16 Oct 1988 (holo BRI; iso NSW).

Dioicous. *Plants* small, older shoots dark green, younger shoots bright green, stems 5–10 mm long, sparingly rhizomatous, unbranched or sparsely branched by subfloral innovations, with dimorphic leaves; rhizoids reddish-brown, finely papillose; *rosette leaves* dark olive-green with red tints, narrowly obovate to spatulate, contorted when

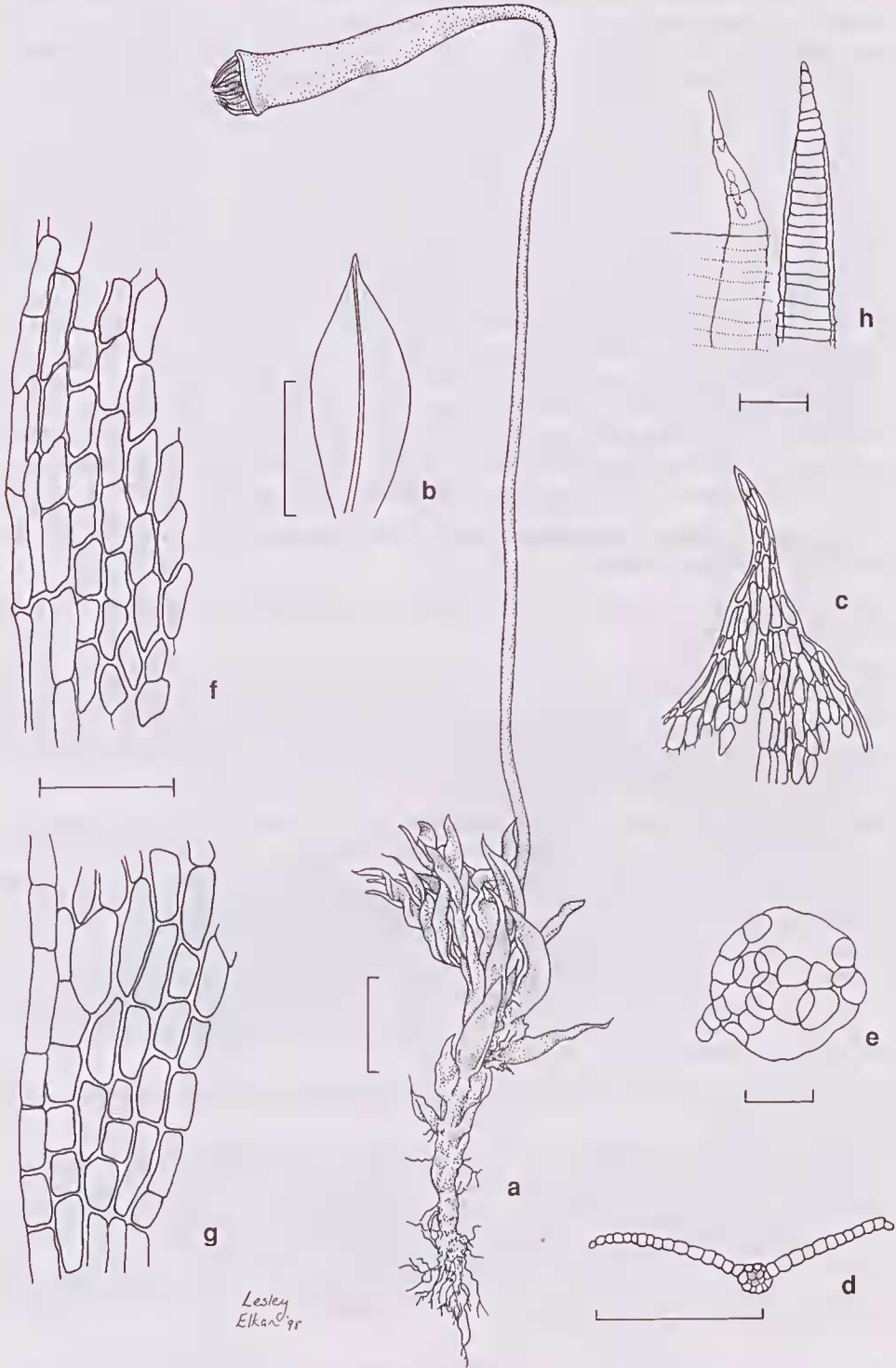


Fig. 2. *Rosulabryum queenslandicum*. a, habit with sporophyte attached (dry); b, leaf; c, leaf apical cells; d, transverse section of leaf; e, gemma — rhizoidal tuber; f, midleaf cells; g, basal cells; h, peristome (from Spence 5167). Scale bars: a, b = 1 mm; c, e-h = 100 μ m; d = 400 μ m.

dry or often spreading and flattened, spreading when wet, not decurrent, strongly carinate, 2–3 mm long, costa strong at base, rapidly narrowing above and not reaching apex to percurrent or shortly excurrent as mucro, colourless above, reddish below, small apiculus often present, upper-middle lamina cells irregularly rhomboidal, 45–75 μm long, 12–20 μm wide (2–3:1), becoming longer and more rectangular below, border absent or weakly developed below; teeth large, colourless, confined to upper half of lamina, giving a hyaline-margin to upper lamina; sterile *innovation leaves* bright green, equidistant, not rosulate, broadly ovate to obovate, 1–2 mm long, decurrent; *costa* not reaching apex, colourless, margin strongly serrate with clear teeth sometimes reaching leaf base, teeth often at right angles to border, lamina cells same as in rosette leaves; *costa* cross-section showing strong dorsal stereid band and guide cells. *Gemmae* filamentous, in small clumps, short, mostly unbranched with almost smooth walls; rhizoidal tubers red-brown, highly variable, irregularly on rhizoids 100–500 μm . *Inner perigonial leaves* smaller than outer leaves, broadly ovate, apiculate. *Perichaetial leaves* narrower. *Seta* long, exerted 1.8–2.0 cm; capsule clavate to pyriform, somewhat inclined; operculum conic; *peristome* double, exostome teeth 16, irregularly striate on outer surface, short lamellae on inner face, teeth tapering to a hyaline apex; endostome segments 16, almost as long as the teeth on high basal membrane, papillose; cilia 3, appendiculate. *Spores* 15–25 μm wide. Chromosome number unknown. (Fig. 3).

Derivation of epithet: this species is named for the Lamington Plateau where the first author observed and collected it.

Habitat: corticolous on bases of trees, including tree-ferns and tall old eucalypts, on fallen logs and soil.

Distribution: the species occurs in the upper elevations of the New South Wales–Queensland border ranges and on the Atherton Tableland. It is most common on the outskirts of *Nothofagus moorei*-tree-fern forests of the McPherson Range on the Lamington Plateau, extending along paths into drier *Eucalyptus* forest. It is found on soil or rocks and on the bases of old *Eucalyptus* trunks.

Other specimens examined: Queensland: Cook: near turn-off to Millaa Millaa Falls, *Ramsay 255*, 5 Oct 1985 (NSW); on semi-exposed boulder, Tinaroo perimeter road, Danbulla S.F., 23 km SE of Mareeba, *Streimann 57742*, 25 Oct 1995 (CANB); on trunk of large *Eucalyptus*, Hugh Nelson Range, *Streimann 29375*, 25 June 1984 (CANB); cave entrance, Downey Creek, Innisfail, *Stone 24739*, 20 Sep 1987 (MELU). Moreton: on rotting log in small clearing in beech forest, west side of Mt Hobwee, Lamington Plateau, *Spence 5191a*, 4 Jan 1993 (NSW); on rotting tree-fern trunk, junction of track to Mt Hobwee, Lamington Plateau (1000 m), *Spence 5192*, 4 Jan 1993 (BRI); St Lucia, Brisbane, *Stone 13122*, 4 May 1978; Cedar Creek N.P., Tambourine Mtn, *Mertens s.n.*, 25 Sep 1988 (BRI); on path in *Eucalyptus* forest, Cedar Creek N.P., Tambourine Mtn, *Mertens 2a*, 16 Oct 1988 (BRI); Cedar Creek N.P., Tambourine Mtn, *Mertens 4*, 30 Oct 1988 (BRI).

New South Wales: North Coast: Gibbergunyah Reserve, Whian Whian State Forest, *Stone 13591*, 30 May 1975 (MELU).

Notes: the narrowly obovate or spathulate, keeled and strongly serrate leaves are very similar to those of *R. subfasciculatum* but the serrations are more distinct and extend to midleaf in *R. lamingtonicum*. The rhizoidal gemmae are red to orange-red in *R. subfasciculatum* but brownish in *R. lamingtonicum*. Overall, the small size and rosulate fertile stems suggest an affinity with *R. capillare*, or one of its Australian relatives, such as *R. leptothrix*, while the filamentous gemmae suggest a relationship to *R. albolinbatum* or *R. epihyticum*.

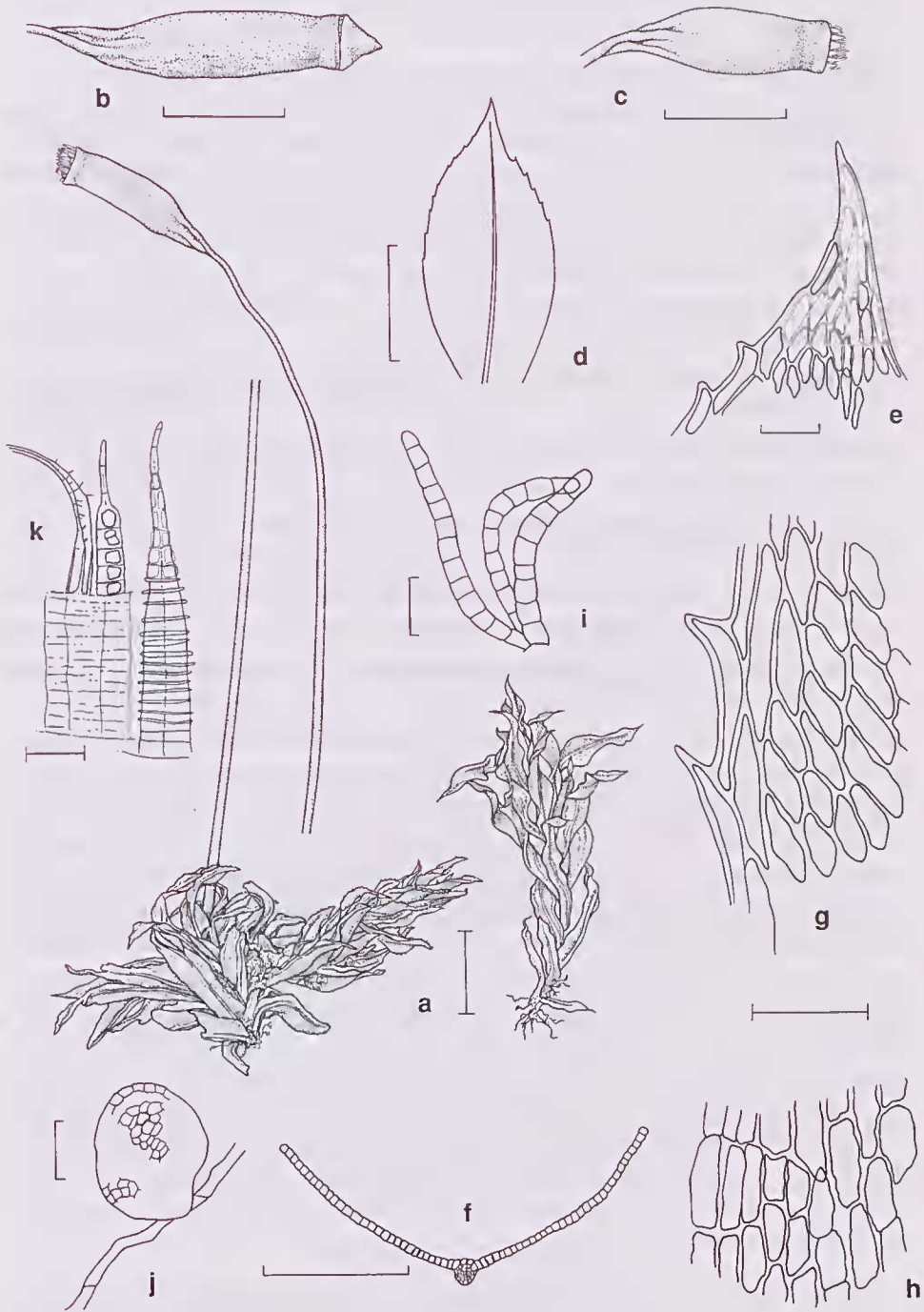


Fig. 3. *Rosulabryum lamingtonicum*. a, habit, with sporophyte (left) and sterile (right) (dry); b, sporophyte with operculum; c, sporophyte showing peristome; d, leaf; e, leaf apical cells; f, transverse section of leaf; g, midleaf cells; h, basal cells; i, filamentous gemmae; j, gemma — rhizoidal tuber; k, peristome (a-c, j-k from Mertens 3, d-i from Spence 5192). Scale bars: a-d = 1 mm; e, g-k = 100 μ m; f = 400 μ m.

Key to the Australasian species of *Rosulabryum*

- 1 Filiform gemmae usually present in leaf axils of sterile stems 2
- 1* Filiform gemmae absent or only rarely present 4
- 2 Stems elongate with equidistant leaves, not rosulate; leaves ovate, upper margins serrulate or entire, costa percurrent or short-excurrent as mucro; epiphytic or corticolous **R. epiphyticum**
- 2* Stems short and rosulate, or if elongate then leaves strongly and coarsely serrate; leaves obovate, margins distinctly serrate, costa variable, not reaching apex to strongly excurrent; on soil, rock or decaying wood 3
- 3 Leaves strongly keeled, narrowly ovate to spatulate, sharply serrate from apex to midleaf, filamentous gemmae with \pm smooth walls **R. lamingtonicum**
- 3* Leaves flat when wet, broadly obovate, serrate near apex, filamentous gemmae coarsely papillose **R. albolimbatum**
- 4 Lamina cells elongate (6–8:1), to 125 μm long; rhizoidal tubers present, flattened, with strongly protuberant walls **R. tuberosum**
- 4* Lamina cells mostly shorter and/or broader 2–4:1 generally <80 μm long, tubers mostly spherical with cell walls not protuberant, or tubers absent 5
- 5 Synoicous, rarely dioicous. Leaves contorted when dry, only rarely spirally twisted around stem; tubers bright orange or crimson **R. torquescens**
- 5* Dioicous. Leaves variously contorted, spirally twisted or imbricate when dry; tubers various colours, not bright orange or crimson 6
- 6 Leaves mostly <3 mm long, sometimes spirally twisted around stem, tubers <300 μm wide if present 7
- 6* Leaves larger, 4–10 mm long or more, contorted but not spirally twisted around stem, or sometimes imbricate; tubers large, mostly >500 μm wide 11
- 7 Stems very short (<1 cm long). Leaves very small (<1 mm long), rosulate, ovate, border weak or absent above; rhizoidal tubers small (<100 μm), reddish-brown, irregularly spherical, elliptic or pyriform **R. queenslandicum**
- 7* Stems longer (usually >1 cm or more). Leaves larger (1–3 mm), obovate or if ovate then upper lamina cells elongate (4–5:1); rosulate or not; tubers >100 μm and mostly spherical 8
- 8 Leaves keeled, narrowly ovate-lanceolate or spatulate, not rosulate except for perigonal and perichaetial buds; margins distinctly serrate in upper half of leaf; rhizoidal tubers small, brownish **R. lamingtonicum**
- 8* Leaves flat, not keeled or if so margins mostly entire, obovate to ovate, margins serrate to almost entire, teeth only in upper third of leaf, rhizoidal tubers red, crimson to orange red 9
- 9 Leaves narrowly ovate and acuminate, somewhat keeled near apex, margins mostly entire, upper lamina cells elongate and sublinear (4–5:1); tubers red to orange
..... **R. leptothrix**
- 9* Leaves acute, ovate to obovate, upper margins generally serrulate to serrate; upper lamina cells short and broad (2–4:1); tubers red, crimson or red-brown 10

- 10 Tubers red-brown, same colour as rhizoids; leaves distinctly spirally twisted; capsules mostly brownish, generally horizontal or suberect; inner peristome apex gradually acuminate into projection *R. capillare*
- 10* Tubers bright red or crimson; leaves contorted but rarely spirally twisted; capsules often bright red, nutant; inner peristome apex rounded and abruptly apiculate
..... *R. torquescens*
- 11 Leaves appressed to stem, imbricate, not much contorted when dry, concave; upper and middle lamina cell walls firm to distinctly incrassate; tubers mostly lacking ..
..... 12
- 11* Leaves variously contorted when dry, not imbricate, generally not concave; upper and middle lamina cells thin to firm walled but rarely incrassate; tubers generally present 14
- 12 Upper leaf margins with extremely wide border (>4 layers), finely crenulate; rhizoidal tubers present (New Zealand Subantarctic Is.) *R. perlimbatum*
- 12* Upper leaf margins with narrow border or border almost absent, distinctly serrate; rhizoidal tubers absent 13
- 13 Plants golden or brown-green; hairpoint long, straight, golden-brown
..... *R. campylothecium*
- 13* Plants red-green; hairpoint very short as a recurved mucro *R. microrhodon*
- 14 Stems distinctly rosulate; lower leaves smaller than upper leaves 15
- 14* Stems elongate, not distinctly rosulate with equidistant leaves, occasionally crowded and enlarged at apex 16
- 15 Upper leaf border very wide (>4 layers), strong, often hyaline; leaves mostly elongate-spathulate; seta usually (>80% of sporophytes) hooked at capsule base
..... *R. subtomentosum*
- 15* Upper leaf border narrow (1–3 layers), not hyaline, often indistinct; leaves mostly obovate; seta rarely (<20%) hooked at base of capsule *R. billardierei*
- 16 Plants with strongly keeled leaves wet or dry, elongate, ovate-lanceolate to spatulate
..... *R. subfasciculatum*
- 16* Plants with flat non-keeled leaves, broadly ovate to ovate 17
- 17 Upper leaf border wide (>4 layers), often hyaline; leaves elongate-spathulate; gametangia not conspicuously enlarged; old leaves and stems often blackish; capsule mouth straight; tubers present *R. subtomentosum*
- 17* Upper leaf border narrow (1–2 layers), often indistinct, never hyaline; leaves broadly-ovate; gametangia conspicuously enlarged; plants remaining green or brown-green; capsule mouth oblique; tubers absent *R. wightii*

Distributions and ecology

Recent work (this paper, Spence & Ramsay 1996 a, b) has shown that the genus *Rosulabryum* is quite diverse in Australasia. Syed (1973) and Mohamed (1979) recognised nine species (in the *Bryum* sections *Capillaria* and *Rosulata*, now *Rosulabryum*) from the region. Ochi and Streimann (1987) added *Bryum wightii* (= *R. wightii*), and Spence and Ramsay (1996b) added *R. subtomentosum*. One species, *Bryum chrysophyllum*, was also included based on a collection from Queensland (Ochi & Streimann 1987), but Mohamed (1979) had already pointed out that it was

indistinguishable from *Bryum subfasciculatum*, a decision with which we agree. Finally, the recently described *R. tuberosum* was added (Spence & Ramsay 1996a), based on collections from Queensland.

In Australia there are three species of *Rosulabryum* that produce filamentous gemmae, two species being newly described here. They can be readily distinguished from each other. *R. albolimbatum* has gemmae that are light to dark red-brown, darker than the rhizoids, often short (10 cells) and single or branched with coarsely papillose walls that are distinct from the other two species. The gemmae of *R. launingtonicum* are paler than rhizoids and have almost smooth walls, whilst those in *R. epiphyticum* have strongly but finely papillose walls, are paler than the rhizoids, often longer (20 cells) and rarely branched compared with *R. albolimbatum*. The third new species, *R. queenslandicum*, does not have filamentous gemmae but produces rhizoidal tubers. Both *R. epiphyticum* and *R. launingtonicum* also produce rhizoidal tubers.

With the three new species described here, the total of species in Australasia increases to 15. *Rosulabryum perlimbatum* is restricted to the New Zealand subantarctic islands. Of the remaining 14, five are endemic to Australia: *R. epiphyticum*, *R. queenslandicum*, *R. launingtonicum*, *R. albolimbatum*, and *R. leptothrix*. *Rosulabryum microrhodon*, originally thought to be endemic to Tasmania, is also known from north-west South Island, New Zealand, based on a single collection (Spence & Ramsay, unpublished data). Another two species, *R. subfasciculatum* and *R. tuberosum*, are predominantly tropical in distribution, with the former being Australian–New Caledonian and the later Australian–south-east Asian. Two species, *R. capillare* and *R. torquescens*, are temperate–cosmopolitan, while another two species, *R. billardierei* and *R. campylothecium*, are temperate to subtropical in the southern hemisphere. *Rosulabryum subtomentosum* is a widespread Australasian temperate species. The most unusual disjunct distribution is shown by *R. wightii*, which is found in the high elevation ranges bordering eastern Australia and in southern India.

Of the 15 species recognized from Australasia, 14 are found in Australia. It is likely that these 14 species may not represent all species of *Rosulabryum* in Australia, and that further collecting in remote under-collected areas will reveal additional species new to science. The present distribution for each of the three new species described here is also likely to be extended. Future field work in the wide variety of habitats of the vast region extending from Cape York to New South Wales, west of the Dividing Ranges, might also result in the discovery of additional species of *Rosulabryum*.

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